

December 14, 1972

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION SPECIFICATION

INSTALL MAJOR ELECTRONIC EQUIPMENT AND PROVIDE AND INSTALL OTHER OPERATING EQUIPMENT IN THE LOW ACTIVITY ATCT STRUCTURE

1. SCOPE

1.1 Scope.- The Federal Aviation Administration is implementing a low activity airport traffic control tower program to provide facilities at relatively small airports in order to perform air traffic control operations. The establishment of each facility is divided into three divisions: Division 1 - Site Preparation; Division 2 - Airport Traffic Control Tower Structure; and Division 3 - Furnishing and Installing Radio Channel Control Equipment, Installing Government Furnished Transmitters and Receivers and Providing and Installing Other Types of Equipments. This specification and associated drawings are intended to show the general arrangement and the extent of the work contemplated under Division 3. The work covered by this specification is to furnish and install all major electronic equipments, to provide the services and materials necessary for installation of GFM, and to provide and install other types of equipments in the low activity level ATCT. Implementation of these requirements in the completed low activity level ATCT structure will result in a fully operational facility except for airfield lighting controls, telephone company equipment, and navaid monitor/control systems, if any. The excepted items will be furnished and installed by others.

2. APPLICABLE DOCUMENTS

2.1 FAA documents.- The following FAA specifications, standards and drawings of the issues specified in the invitation for bids form a part of this specification and are applicable to the extent specified herein.

FAA-E-2219	Clock, Single Line, 24-Hour
FAA-E-2214	Gun, Signal Light, Portable
FAA-E-2229	Reels, Portable Signal Light Gun
FAA-E-2290	Radio Channel Control Equipment
FAA-E-163	Rack, Cabinet and Open Frame Types
FAA-STD-001	Color and Texture of Finishes for National Airspace System Equipment
FAA-STD-012	Paint Systems for Equipment
FAA-STD-013	Quality Control Program Requirements
FAA Drawing C-4853a	Vent Header Altimeter Setting Indicator Assembly and Details
FAA Drawing D-4971	Installation of Light Adapter for Altimeter Setting Indicator
FAA Drawing D-46000-1	TX/Rec/Control System Diagram Using Solid State Control
FAA Drawing D-46000-2	Solid State, Radio Channel Control Equipment, Block Diagram; (Wherever "VHF" is shown change to "VHF/UHF")
FAA Drawing D-46000-6	Installation and Fabrication Details. Only the circularly Polarized Antenna and Note #1 is applicable. The UHF disc-cone antenna Type FA-7958, or equal, is to be similarly installed and connected to UHF RF equipment at locations designated for UHF equipment. The pipe on which the disc-cone antenna is installed is $1\frac{1}{4}$ " IPS rather than $2\frac{1}{2}$ ".
FAA Drawing D-5947-1	Console Layout Details for Solid State Control Equipment
FAA Drawing D-5947-2	Console Base Units and Miscellaneous Details for Solid State Control Equipment
FAA Drawing D-5947-3	Console Turret Details for Solid State Control Equipment

Copies of these specifications and other applicable FAA specifications, standards, and drawings may be obtained from the Contracting Officer in the Federal Aviation Administration Office issuing the invitation for bids. Requests should fully identify material desired, i.e., specification, standard, amendment, and drawing numbers and dates. Requests should cite the invitation for bids or the contract involved or other use to be made of the requested material.

2.2 Federal standard.- The following Federal standard forms a part of this specification:

FED-STD-595 Federal Standard Colors

Information on obtaining copies of Federal specifications and standards may be obtained from General Services Administration offices in Atlanta; Auburn, Wash.; Boston; Chicago; Denver; Fort Worth; Kansas City, Mo.; Los Angeles; New Orleans; New York; San Francisco; and Washington, D. C.

2.3 Military specifications.- The following Military specifications form a part of this specification:

MIL-C-17D Cables, Radio Frequency, Coaxial, Dual Coaxial,
Twin Conductor, and Twin Lead

Single copies of Military specifications, standards, and handbooks may be requested by mail or telephone from U. S. Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pa. 19120 (for telephone requests call 215-697-3321, 8 a.m. to 4:30 p.m. Monday through Friday). Not more than five items may be ordered on a single request; the invitation for bid or contract number should be cited where applicable.

2.4 Department of Commerce, Weather Bureau.- The following specifications form a part of this specification:

Spec. No. F420C-SP001 Wind Measuring System

Spec. No. 450.7205 Indicator Altimeter Setting

Single copies of Weather Bureau specifications may be obtained from Federal Aviation Administration, Washington, D.C. 20591, Attention: Contracting Officer. Requests should cite the invitation for bids, request for proposals, or contract for which the material is needed.

2.5 Commercial Standard.- The following commercial standard form a part of this specification:

CS 35-61

3. REQUIREMENTS

3.1 General.- The contractor shall furnish all plant, labor, materials, and equipment in accordance with this specification, including inspection requirements to provide a fully operational facility at each of the locations specified.

All work will be performed, and equipment installed in three locations in the tower structure: the Junction Room below the cab, inside the cab, and on the roof of the cab. The major portion of work will be done in the tower cab. This includes installation of consoles on three or four of the six cab sides, installation in the consoles of other operating equipment for two or three radio positions and one flight data position, and installation of other miscellaneous items detailed in this specification.

3.1.1 Shop drawings.- Prepare and submit samples and certificates for materials and equipments required to complete the work outlined in this specification. Drawings shall be submitted showing actual layout and details of installation work in the tower cab. Submit a reproducible copy of each shop drawing on an as available basis. Shop drawings will be used for FAA information and record purposes.

3.1.2 Spare parts provisions.- The contractor shall prepare a replaceable parts list and items identification, for each type of equipment specified in this specification, in accordance with the contract documents. Spare parts will be provided in accordance with the provisioning method specified in the contract.

3.2 Contractor furnished material.- Equipment shall be furnished by the contractor in accordance with the contract.

The contractor shall also furnish all cable and other materials needed to properly install the equipment in the tower structure. All materials shall be new and the best of their respective kinds.

Some of the materials in the contract are listed by manufacturer model number. It is not the intention to limit consideration to the materials of the manufacturers listed; however, the materials listed shall establish the following standards for each item. Deviations from these standards shall be approved by the Contracting Officer, in writing, before any other material is used. As applicable, the standards for evaluation of items shall be as follows:

1. Size
2. Function
3. Reliability/Quality
4. Appearance

Items proposed in lieu of an item specified shall be comparable to the standards of the listed product with respect to the above listed standards as a minimum requirement. Full and complete catalogue illustrations, specifications, and descriptive data defining in detail each item shall be submitted for approval as outlined herein, before placing any order for such item.

3.3 Government furnished material.- The following items will be furnished to the contractor by the Government:

Transmitter VHF/UHF	2 each, 3 each, or 4 each	} As shown in the contract
Receiver VHF/UHF	2 each, 3 each, or 4 each	

NOTE: Contractor shall provide crystals, type CR-75/U with HC-6U Holders per military specification MIL-C-3098E.

The material will be made available F.O.B. to the contractor at the FAA Depot, Oklahoma City, 30 days prior to the start of equipment installation at each site.

3.4 Workmanship.- All fabrication and installation work, where not specifically detailed in this specification shall be done in accordance with the best industry practice and shall be performed by experienced workmen regularly employed in this type of work. Use and/or installation of products manufactured by others shall be in strict accordance with manufacturer's instructions.

3.4.1 Protection of work and materials.- The contractor shall be responsible for the unloading, care and protection from weather, theft, vandalism, or other factors of all materials (CFE, CFE, etc.) delivered and work performed until completion and final acceptance, whether or not the same has been covered by partial payments made by the Government and whether or not damage to his work was caused by the contractor or by others except for damage caused by employees of the Government acting in the course and scope of their employment.

3.4.2 Restoration and touch-up.- All furnishings and equipment shall be protected from damage before and during installation. Scratches, nicks, dents, and other blemishes shall be repaired and equipment restored to new condition after installation. Any nails, screws, bolts, etc., shall be touched up as necessary to match surrounding material. Prior to repair of damaged equipment, the Contracting Officer's Representative shall be consulted and the material repaired or replaced at his option. In either case, there shall be no expense to the Government except as noted in paragraph 3.4.1.

3.5 Support equipment.- The contractor shall fabricate and install at each control tower location the following support equipment:

- a. Operating consoles installed on three or four walls of the cab and occupying approximately 24 or 30 linear feet of wall space.
- b. Electronic equipment cabinet to house the transmitters, receivers, and interlock equipment described in Section 3.5.2 of this specification.

3.5.1 Consoles.- This section of the specification describes the various tower cab operating console assemblies. The consoles are assembled from base units which are attached to the floor and wall of the tower cab and turrets attached to the base unit. Console configuration for sitdown operation shall be in accordance with the contract.

3.5.1.1 Construction

3.5.1.1.1 General.- The tower cab consoles shall be constructed of steel framework and formica, or equal, faced plywood. The design and dimensions of each unit shall be as shown on drawings D-5947-1,2,3. The framework shown is a schematic arrangement depicting overall size of units, configuration, and typical features of construction required. Either standard commercial shapes or specially formed members shall be used for the framework provided that the shapes selected are suitable for the intended purpose. All joints and welds shall be ground or filed smooth so that the panels will fit snug and smooth. Each console unit shall be designed to be jointed to adjacent units or to be fitted with a cover panel. Hinged turret tops and removable panels shall be provided as shown on the drawings. The assembly of the console units shall result in a compact arrangement without gaps or misalignment. Hinges, catches, etc., shall be secured only to the faces of plywood.

3.5.1.1.2 Materials.- The steel framework shall be not less than 16 gauge (0.0598") cold rolled steel shaped into structural configurations of channels, angles, or other standard forms to given strength and rigidity to the frame. The manufacturer may substitute commercially rolled shapes for the framework providing the clearances and mounting surfaces are maintained. The wood panels shall be made of 1/2 inch plywood, Type II, medium density, good grade, commercial standard CS35-61, with smooth, close grain, paintable surface and lumber of laminated core. The plastic surface shall be 1/16 inch formica, or equal, bonded with waterproof adhesive to the wooden panel.

3.5.1.1.3 Base unit.- The base unit shall have a framework of steel welded into a rigid frame as shown on the drawing. The front panel shall be of formica faced plywood. One right and one left end panel of formica faced plywood shall be furnished to finish the row of consoles. The edges of the end panels shall be edge banded with formica on the top and front edges.

3.5.1.1.4 Turrets.- Turret units shall be of three different configurations as shown on the drawings. The turrets shall have a rigid steel welded framework for attaching to the base unit and to support the turret top and the overhanging shelf. The front skirt and base panel of every turret shall be of formica faced plywood. The frame shall be so constructed that the deflection shall not exceed 1/8 inch when a concentrated load of 200 pounds is applied to the center of the shelf one inch from the leading edge of the turret. One each right and left hand panel shall be provided with the top and front edges banded for finishing the row of consoles. These panels shall be formica faced plywood. All joints made in formica faced plywood shall be glued and mitered in accordance with architectural woodwork quality standard section 400, Custom Grade.

3.5.1.1.4.1 Desk type.- The desk type turret shall be flat for the full depth of the turret. The surface shall be formica faced plywood with the leading edge of the top mitered and bonded to the front skirt.

3.5.1.1.4.2 Lighting type.- The turret top shall be constructed of formica faced plywood. Glue blocks shall be solid hardwood. A piano type hinge shall secure the top to the rear of the turret frame. The top shall be equipped with a finger pull, magnetic catch, and lift and fall support.

3.5.1.1.4.3 Display type.- Rear turret top construction shall be similar to the lighting type turret. The front turret frame section shall be covered with formica faced plywood to provide a 12 inch shelf. The shelf top and front skirt joint shall be mitered.

3.5.1.1.5 Hardware

- (a) The hinges shall be steel of the continuous type with 3/64 inch thick leaves and 1/8 inch diameter pin.
- (b) The flush ring pull in the turret top shall be Garco Corporation No. 891 or Corbin No. 1246, or equal.
- (c) The wood screws for attaching the panels to the frame from the inside shall be steel round head size 8, 1/2 inch long with a flat washer.
- (d) The screws for attaching the panels to the frame from the outside shall be steel, Size #10, oval head with countersink finishing washers as shown on the drawings.
- (e) The bolts used for attaching the various console unit frames together shall be 1/4-20 hex head machine screws with shakeproof or split ring lock washer and nut.
- (f) The hardware used to fasten the consoles to the cab floor and wainscot shall be as detailed on Drawing D-5947-1.
- (g) The lift and fall support shall be National Lock Company Model A61-973 or equal.
- (h) The magnetic catch shall be Stanley Model 41A1D or equal.

3.5.1.1.6 Finish.- Plastic surface of plywood shall be formica suede finish Gingersnap 834, or equal. All plywood panel edge not edged with formica shall be banded with lumber edging and finished to match plastic surface. The metal console framework, ventilation grilles, floor light louvers, strip storage box and jack unit recess brackets shall be cleaned, pretreated, and painted in accordance with FAA-STD-012, System AS-1. Finish conforming to FAA-STD-001.

3.5.1.2 Installation

3.5.1.2.1 General.- Assemble each console so that it is plumb, square, and level with all panels and required accessories securely attached to the steel framing. Each unit shall be placed as shown on drawings with joints between them tightly butted. Shim the units as required to level and plumb them so the exterior surfaces are in perfect alignment. Secure the consoles to the floor and walls and to the adjacent unit(s). After completion of the console assembly, all hinged turret tops shall operate freely without binding.

3.5.1.2.2 Rubber writing surface.- Apply rubber writing surface to display console shelves. The surface shall be continuous for the line of display consoles of each wall. The rubber writing surface shall be red, cloth finish rubber sheet, 1/8 inch thick having 60 durometer hardness. Apply the rubber sheet to the laminated plastic shelf surface with adhesive, Bargas cement, or equal.

3.5.1.2.3 Console grounding.- Each console frame shall be fitted with a ground bus of #6 AWG soft drawn copper wire. Each wire shall be straight along the length (height) of the module, be attached to the module with "J" lugs as needed to lie flat against the side, and attached near the bottom of the module with pressure lugs to a length of #6 AWG soft drawn copper wire which shall run the breadth of all consoles. This latter bus wire shall either run continuous through the floor entry conduit, along the cable tray to the station ground bus located in the Junction Room where it will be connected with a suitable pressure type connector, or connected by means of suitable pressure lugs to another length of this type bus wire which shall be run and connected in this manner to the station ground bus.

3.5.1.2.4 Console floor lights.- Louvered incandescent lamp fixtures shall be provided and installed in the console base for the purpose of illuminating the floor of the cab adjacent to the console. The fixtures shall be Underwriter's Laboratory approved and similar in configuration to Solux No. AK970. All fixtures shall be controlled by a single electronic dimmer equal to Lutron D 600P or Thomas Industries M 6502. The fixtures dimmer shall be installed in the consoles as shown on drawings D-5947-1,2,3.

3.5.1.2.5 Ventilation grilles.- Ventilating grilles shall be installed in console base access doors as shown on Drawings D-5947-1, 2, 3. Louver construction shall match floor light louvers.

3.5.1.2.6 Mounting equipment on consoles.- All items of equipment to be mounted on the console (wind readout, communication control, light switches, etc.) shall be installed in the following manner:

A neat, smooth-edged opening to receive the equipment shall be cut to the proper size and in the position designated on the applicable drawing. Equipment placed in the opening shall be free and clear of binding on the edge of the opening. Connecting wires and cables shall be installed with slack in accordance with Sections 3.6 and 3.7 of this specification.

The cut edge of the opening shall be completely covered by the equipment flange. Equipment shall be secured to the panel with appropriate screw fasteners so that the equipment can be removed from the front of the console without damaging or disassembling the console. All panels and equipment shall present a smooth finished appearance when installed.

3.5.1.2.7 Miscellaneous work in consoles.- Installation of communications panels and wiring; power wiring; ceiling light dimmer controls; door lock controls; and monitor systems shall be in accordance with Section 3.7 of this specification.

3.5.1.2.8 Console drawers.- Fabricate and install one pull out drawer for each console position in the tower cab. Each drawer shall be 18" wide, 11" deep, and $1\frac{1}{2}$ " high, faced with matching formica and finger pulls.

3.5.2 Electronic equipment cabinets.- The electronic equipment cabinets shall be 83 inch steel cabinet built in accordance with Type III of FAA-E-163b specification without options. The cabinets shall be anchored to the floor of the Junction Room with expansion shields and $\frac{1}{4}$ inch bolts, or equal. Support channels shall be furnished and installed for transmitter and receiver mounting slides. Refer to the electronic equipment instruction manuals for slide details. The electronic equipment cabinets shall be located in the Junction Room.

Fabricate and install protective covers dimensioned to cover the front of each equipment rack. The covers shall be constructed of plexiglass, with sufficient slip out hinges and provided with a pushbutton latch.

Furnish and install blank panels in accordance with Type III of FAA-E-163b specification without options for unused rack spaces in the equipment cabinets.

3.6 Electronic installation requirements.- Transmitters, receivers, audio jack panels, control equipment, and antennas shall be installed in the tower cab as shown on Drawings D-46000-1, D-46000-2, Detail A and Note #1 of D-46000-6, D-5947-1, D-5947-2, and D-5947-3.

3.6.1 Installation.-

3.6.1.1 General.- Furnish and install audio jack panels type GRM Number AJP20FA, or equal, in the equipment cabinet. The audio jack panels shall be wired as shown on Drawing D-46000-1, Detail C. Mount electronic equipment and form and terminate connecting electrical harnesses not supplied with equipment. Pull and terminate power wiring to DC power circuit panel. Prepare cutouts in tower panels, install, and terminate electronic equipment. Interconnect control equipment with cables furnished with the equipment and make the necessary connections between the control equipment and receiving and transmitting equipment. On equipment provided with slides, sufficient slack shall be left in the cable harness to permit the slides to be extended to full length without placing undue strain or tension on the connecting cables. A support means shall be provided to prevent crimping of cables when equipment is recessed to maximum depth. All cable harnesses shall be supported as necessary with conduit cable stay strap ties (or equal) to provide a neat workmanship-like installation.

3.6.1.2 Mounting slides.- The receivers and transmitters are equipped with mounting slides to permit the units to be extended for servicing. The contractor shall furnish or fabricate necessary hardware for installation of these slides. Reference shall be made to the technical instruction manuals furnished with these equipment units for data regarding slide installation. Proper mounting screws for equipment installation shall be furnished by the contractor.

3.6.1.3 System wiring.- All control and audio systems shall be checked and corrections made to the system wiring, regardless of terminations shown on drawings or instructions contained elsewhere to achieve the intended operation and functions of the ATCT.

3.6.1.3.1 Jack Mounting.- Mount the recessed jacks for handsets and/or headsets in the sloping front of the console turret. The exact location will be determined at a later date.

3.6.1.3.2 Demarcation box.- Fabricate and install telephone/radio demarcation box as shown in Revision B to Drawing D-46000-1. This requirement is for one demarcation box per tower to be located in the equipment room.

3.6.1.4 Antenna installation.- Install antennas with mounting hardware on tower cab roof. Provide accompanying coaxial cable runs from these antennas to RF equipment located in the Junction Room. Terminate coaxial cable at antennas and in the Junction Room. Masts and mounting hardware for antennas shall be designed to withstand 120 MPH winds. RF-213 coaxial cable shall be furnished in accordance with Standard MIL-C-17D. The coaxial cable from each antenna shall be routed from the antenna via 2-1/2 inch pipe to the cab ceiling space, and then down the cab columns to the junction roof level below the cab. At this point, a clamp assembly will be installed to secure the coaxial cables. The coaxial cable will then be routed via cable tray to the 6-inch conduit sleeves to the RF equipment. RF bodies, shall be installed on the front surfaces of rack panel/s mounted to the front of the equipment rack/s in the junction room. Suitable holes complete with protective grommet material, shall be provided in the panel/s to provide RF cable access such that the RF cables can be connected to the RF bodies without the use of right angle fittings. The holes shall be such that cables can be disconnected for maintenance purposes and reconnected without damage or chaffing of the cable covering material. Installation shall be such that access to the RF bodies is gained by opening only the plexiglass door on the rack. VHF antennas shall be swastika type FA-8949 A or B. UHF antennas shall be discone type FA-7845A.

Permanent type cable markers shall be installed on each coaxial cable at the antenna, and in the Junction Room identifying the cable by RF frequency designations. Cable bends in RF transmission lines shall have a bend radius of at least ten times the diameter of the cable.

3.6.2 Adjustment and performance requirements for radio channel control equipment.- The Contracting Officer or his representative will make available to the contractor all of the instructional material ordinarily used by the FAA to effect system and system component tuneup. VHF/UHF receivers shall be tuned and adjusted to the specified frequencies and shall meet or exceed in performance the tolerances listed in the adjustment and the performance requirements.

The ATCT transmit, control and receive systems shall be adjusted using guidelines herein with levels set as shown. The contractor shall document all tuneup adjustments, certifying the document, and turn over the document to the Contracting Officer or his representative. The Contracting Officer or his representative shall reserve the right to require demonstration of any or all adjustments to assure that proper operation will be achieved.

3.6.2.1 ATCT control system operation

3.6.2.1.1. General.- Prior to system checkout, each unit shall be checked to see that proper fuses, indicator lamps, and relays are installed.

3.6.2.1.2 Performance tests.- The adjustments and checkout procedure detailed in the instruction book for the radio channel control equipment Type FA-8165, or equal, shall be performed to insure that the system is in proper operating condition. Note that this equipment requires a 12 volt DC power source as compared to 24 volts DC for the radio frequency equipment.

3.6.2.2 Antennas, Transmitters, and RF transmission lines

3.6.2.2.1 General.- Antennas and RF transmission lines are to be tested under conditions stated below and shall meet the tolerances indicated.

3.6.2.2.2 Antenna tolerances.- With a 500-volt insulation tester, measure the insulation resistance of the antenna from the coaxial connector closet to the antenna. An infinite resistance is the standard; however, a reading as low as 50 megohms is in tolerance.

3.6.2.2.3 RF system tolerances.- Using a 500 volt insulation tester, measure the insulation resistance of the coaxial line with it connected to the associated antenna. As one common antenna per channel is used in a transmit/receive configuration using coaxial relay switching in the transmitter, tests should be made from both the receive and transmit sides of the coaxial relay. An infinite resistance is the standard; however, a reading as low as 50 megohms is within tolerance. Upon satisfactory completion of tests, restore all antenna and transmission line connections. The VSWR at the transmitter end of the transmission line shall not be greater than 2.5/1. The transmitter output power shall be at least ten watts measured at the transmitter output.

3.6.2.2.4 Modulation.- Modulation of the transmitters shall be adjustable to 90 percent with input audio signals within the operating frequency and at levels of -35 dBm to +10 dBm.

3.6.2.2.5 Maximum allowable frequency deviation.- Under all combinations of applicable operating conditions, including combinations where the net effects are additive, the total frequency deviation shall not exceed $\pm 0.002\%$ of the designated carrier frequency.

3.6.2.3 ATCT receive system audio levels.

3.6.2.3.1 General.- The audio levels of the ATCT receiving equipment shall be set by the following procedure.

3.6.2.3.2 Test equipment required

- (a) VHF/UHF signal generator
- (b) Frequency meter
- (c) VTVM
- (d) 600/600 ohm, 20 dB audio attenuator
- (e) Audio oscillator

3.6.2.3.3 Preliminary procedures necessary before actual tests can be performed

- (a) The receivers must meet the requirements specified in paragraph 3.6.2.3.5. (Tabulation of VHF/UHF Receiver Standards and Tolerances). In addition, each must be adjusted to deliver 0 dBm output with STV.
- (b) With a STV fed into the local receivers, the audio output from local receivers is adjusted for 0 dBm.
- (c) All equipment is connected to a normal load unless otherwise specified.
- (d) Equipment Warm-Up - Test equipment and system components shall reach operating temperature before starting any tests.
- (e) Test Equipment Requirements - Test equipment with balanced terminal facilities are used in measuring or injecting audio signals. The unbalanced input type (HP 400D vacuum tube voltmeter) is used with a 1:1 isolation transformer of at least 600/600 ohms impedance.
- (f) Power Measurement Across Other Than 600 ohms - Power levels stated in dBm are based on 0 dBm equalling 1 milliwatt of power (regardless of impedance). Most power meters with dBm scales are calibrated for use across a 600 ohm impedance. When using these meters to measure power across impedance of other than 600 ohms, use the graph in Figure 1 to obtain the correction factor for the impedance across which the power is being measured.
- (g) Power in Terms of Voltage Across an Impedance - It is frequently necessary to translate power levels stated in dBm to AC voltage across known impedances. Impedances encountered in audio level measurements at agency facilities are usually 25, 50, 600, 6,000, or 20,000 ohms. Figure 2 is a graph with power in dBm plotted as a function of voltage for each of the aforementioned impedances. This graph may be used to convert power level to voltage when the impedance is known.
- (h) RF Signal Generator Frequency - Adjust RF signal generators to the assigned channel frequency.
- (i) Receiver RF Gain Control - Set the receiver RF gain control for a spuelch threshold of five microvolt or better.

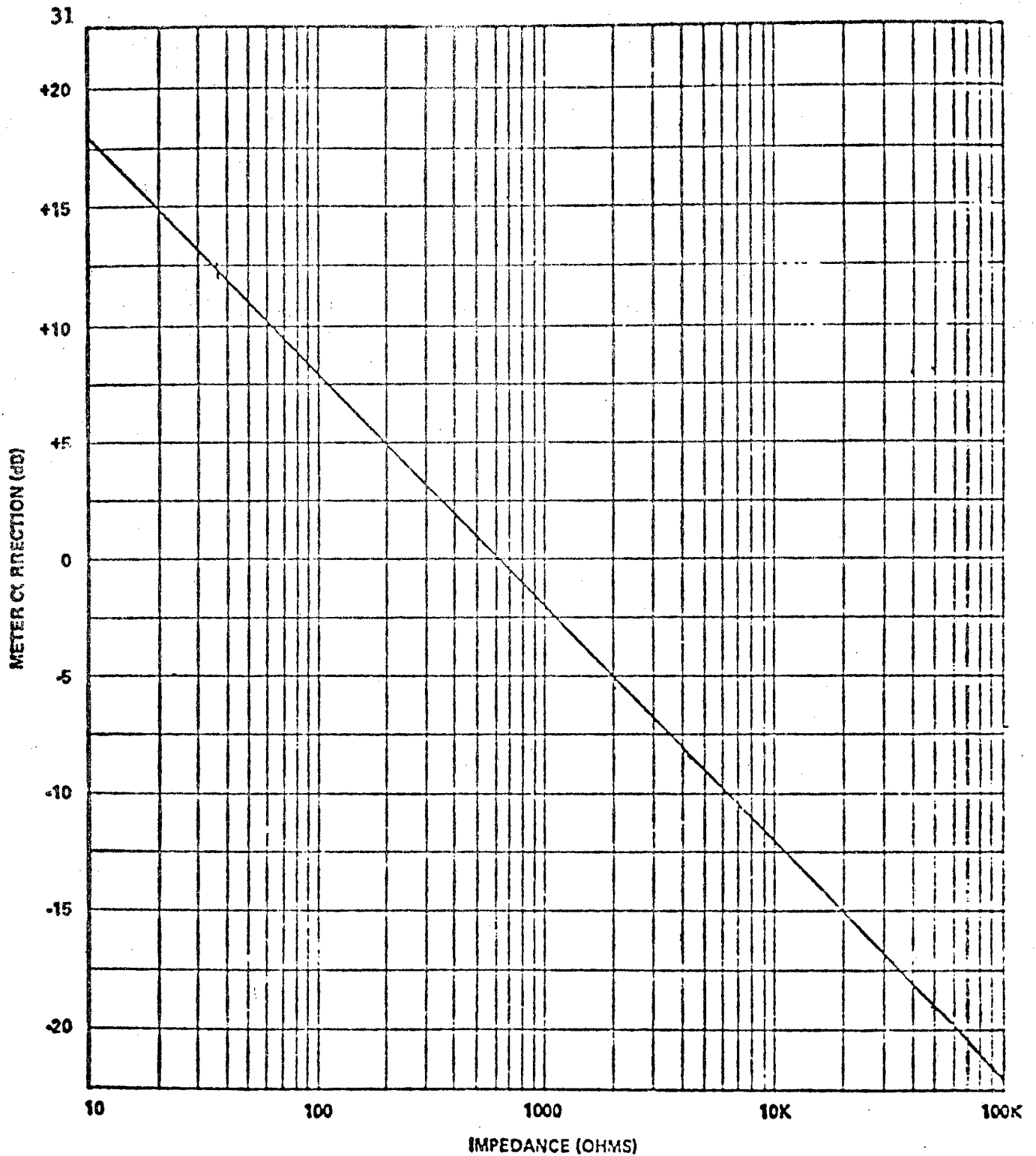


Figure 1 Correction factor for using 600 ohm power meter across other than 600 ohms.

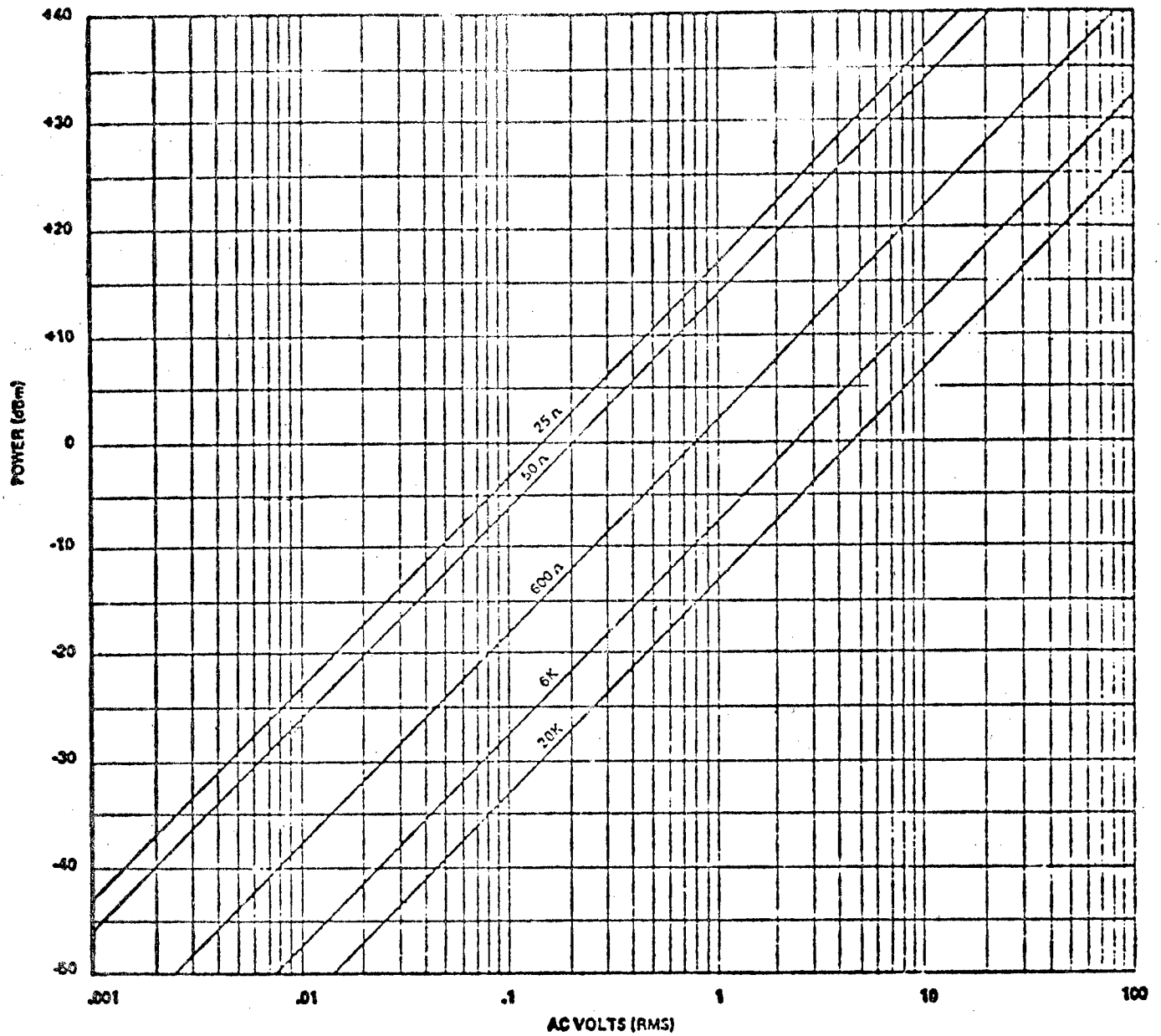


Figure 2 Power in dBm as a function of voltage across a known impedance.

- (j) Receiver Audio Gain Control - The receiver audio gain control is adjusted to the maximum of its range. Lower settings on the VHF/UHF receiver may cause poor AGC operation.
- (k) The Receiver Muting or Audio Quieting Control - The receiver muting audio quieting control is set for minimum noise output from each receiver.
- (l) Receiving System Line-UP - Before starting line-up procedures, the receiving channel equipment is connected to the normal number of positions usually associated with it. Adjustments under this condition will insure adequate lighting of the console neon indicator lamps.

3.6.2.3.4 Detailed procedures for setting ATCT receive levels

- (a) Apply a five microvolt signal modulated 30 percent and 400 Hz to a receiver antenna input connector.
- (b) Adjust the receiver audio output for 0 dBm.
- (c) Select the proper frequency on the position selector unit.
- (d) Adjust the loudspeaker volume control for proper listening level.
- (e) Plug a headset into jack unit and adjust the headset volume control for proper listening level.

3.6.2.3.5 VHF/UHF receiver tolerances. - All receivers shall meet the tolerances tabulated below:

<u>RECEIVER TESTS</u>	<u>TOLERANCE</u>
(a) <u>Sensitivity</u>	
VHF/UHF (AN/GRR-23 and AN/GRR-24)	3 microvolt STV* maximum for 100 mV in 600 ohms
	3.0 microvolt STV maximum to open. Approximately 2/3 of opening value to close.
(b) <u>AVC Threshold</u>	
VHF/UHF	12 microvolt STV maximum
(c) <u>AVC Level Control</u>	
VHF/UHF	4 dB from 15.0 microvolt to 0.5 V STV

*STV - Standard Test Voltage is a signal modulated 30 percent at 400 Hz for VHF/UHF Receivers.

(d) Audio Output

(Maximum Gain) VHF/UHF 100 mW minimum

(e) Frequency

VHF/UHF
Narrow band

Under all combinations of applicable operating conditions, including combinations where the net effects are additive, the total frequency deviation shall not exceed $\pm .002\%$ of the designated frequency.

(f) Selectivity 6 dB Bandwidth

VHF/UHF
Narrow band

+18 kHz minimum

(g) Selectivity 80 dB Bandwidth

VHF/UHF
Narrow band

+40 kHz maximum

+40 kHz maximum

(h) Non-Symmetry 60 dB Points

VHF/UHF

15 percent maximum

(i) Audio Frequency Response

VHF/UHF

Within 3 dB from 300 to 3,000 Hz and continually decrease above 3,000 Hz.

3.7 Miscellaneous equipment installation.- The contractor shall provide and install the following items at each site in accordance with the contract:

- (a) Altimeter setting indicators (ASI).
- (b) Wind speed and direction indicators.
- (c) Wind speed and direction sensors.
- (d) Light guns with reels.
- (e) Console clocks.
- (f) Lighting controls.
- (g) Cable trays.

Generally, the work consists of the following major tasks: Prepare cutouts in the console panels and mount the wind indicators, ASI, clocks, and lighting controls. Mount wind sensor equipment on the cab roof and the ASI vent header on the outside of the cab. Mount the light guns in the boxes provided in the cab ceiling. Install cable trays in the Junction Room. Pull wiring for these equipments and make necessary power and control cable connections in the cab, Junction Room, and the roof.

3.7.1 Altimeter setting indicator (ASI).- Two or three ASIs shall be provided and installed in the operating consoles, one at each of the two or three radio positions as shown on Drawing D-5947-1 and contract. The ASIs shall be furnished in accordance with U. S. Department of Commerce ESSA Specification No. 450.7205 as revised 1 May 1967 with the following exceptions and notes:

- (a) Dial range shall be selected so that the field elevation (MSL) falls within the calibrated range.
- (b) A dial lighting attachment is required.
- (c) The finish shall be in accordance with FAA-STD-012 and FED-STD-595 Color No. 30117. Paragraph 3.9 of the ASI specification 450.7205 is deleted. The fifth sentence of 3.12 is changed to read "The toggle switch and the plate shall have a finish in accordance with FAA-STD-012 and FED-STD-595 Color No. 30117."
- (d) The qualifications testing will be conducted at the factory. The contractor shall notify the Government 10 days prior to scheduled start of testing.
- (e) Nameplate legend shall be furnished to the contractor within 15 days of receipt of his request.

Each ASI will be mounted in the console at the location shown on Drawing D-5947-1. A vent header shall be fabricated as shown in Drawing C-4853 dated 30 January 1968. The vent header shall be firmly attached to the outside cab wall approximately at the mid-point of the front console. A 3/16" diameter copper or aluminum tube shall be connected to the vent header, passed through a hole drilled through the cab wall into the space inside the console and fixed to the inside wall. A tee connector shall be installed at this point, and 3/16" tubing run under the console to each altimeter setting indicator.

Sufficient tubing shall be installed so that the tubing can be pulled up through the hole cut in the console turret panel for the ASI, connected to the ASI, and the assembly then lowered into position on the console. The tubing shall be connected to the case of the ASI by means of a brass 3/16" SAE x 1/8" NPT half union coupling. The entire system from the vent header to the ASI shall be airtight. The hole through the cab wall shall be waterproofed with resilient caulking material. The dial lighting attachment shall be installed and connected as shown on Drawing D-4971.

3.7.2 Wind measuring system.- The contractor shall provide and install one basic assembly and one or two repeater indicator assembly in accordance with National Weather Service Specification No. F420C-SP001 dated 21 September 1970 as modified by the following exceptions and notes:

- (a) The master indicators and repeater indicators shall conform with this specification (paragraphs 3.1 and 3.2)
- (b) Substitute "Matte brown finish in accordance with FED-STD-595 Color No. 30117 applied in accordance with FAA-STD-012" for the words "dull black finish" in paragraph 2 of 3.6.1 and the last sentence of 3.6.2.

- (c) Substitute "Federal Aviation Administration" for "Weather Bureau" in the first sentence on page 16.
- (d) Under "Instruction Books," page 15, change the second sentence of the first paragraph to read "The book shall contain complete instructions on the installation, maintenance, and operation".
- (e) The requirements under "Packing" are deleted since the contractor is responsible for shipping, installation, and proper operation of all components.
- (f) The qualification testing will be performed at the manufacturer's plant. The contractor shall notify the Government 10 days prior to scheduled start of testing.
- (g) Nameplate legend shall be furnished to the contractor within 15 days of receipt of his request.

The wind speed and direction transmitters shall be installed on the roof of the cab in a location which will not be affected by the air conditioning intake or exhaust. The installation shall be in accordance with the manufacturer's instructions and shall be designed to withstand 120 MPH winds. Cables for the roof-mounted equipment shall be passed down through the cab column to the Junction Room below the cab. At this point, a clamp will be installed to secure the cable, and the cable permanently marked with an identification tag. The cable will then be routed via cable tray to the 6" conduit sleeve in the cab floor beneath the center console thence up to the power supply and distribution assembly. The power supply and distribution assembly shall be fixed to the inside of the center console or to the cab wall beneath the console top. The wind speed and direction indicating meters shall be installed in the console turret panels at the locations shown on Drawing D-5947-1 and connected to the power supply and distribution assembly in accordance with the manufacturer's instructions. The power for the dial lights shall be connected from the power supply through the potentiometer to the indicating meters.

3.7.3 Light guns with reels.- One light gun and associated cable reel shall be provided and installed in the tower cab in each of the two light gun boxes provided in the cab ceiling. The light guns shall be furnished in accordance with FAA Specification FAA-E-2214a with Amendment 1 dated 3 October 1968, except that paragraph 4.4 and all of Section 5 are deleted since the contractor is responsible for shipping, installation, and proper operation of all components. The retracting reels for the support cable and the electric power cord shall be furnished in accordance with FAA Specification FAA-E-2229 dated 9 September 1965 as modified by the following exceptions and notes:

- (a) Paragraph 2.1 and 3.6 are deleted. The reels and mounting plate shall be finished in accordance with FAA-STD-012 and FED-STD-595 Color No. 37056 (Brown-Black).
- (b) Paragraph 4 "Preparation for Delivery" is deleted.

The mounting plate, transformer, and retracting reel shall be securely bolted to the light gun box with 1/2" cadmium plated bolts. Electrical connections shall be made in the junction box installed at the end of the light gun box.

3.7.4 Console clocks.- Three or four console clocks shall be furnished in accordance with Specification FAA-E-2219a dated 29 July 1960 with the following exceptions and notes:

- (a) The time display shall be lighted in accordance with paragraph 3.5.2 of the specification.
- (b) A power interruption switch shall be provided in accordance with paragraph 3.5.2.2. An interruption indicator is not required.
- (c) Paragraph 5, "Preparation for Delivery" is deleted.
- (d) Paragraph 3.6, finish, change color reference from No. 30372 to No. 30117. The clocks shall be installed in the console at the location shown on Drawing D-5947-1 and connected to the nearest junction box on the wainscot behind the console.

3.7.5 Miscellaneous monitor/control items.- Six controls for the overhead console lights shall be installed in the operating console as shown on Drawing D-5947-1. Similarly, an electric door lock control, P fixture switch and a standby power monitor light will be furnished and installed in the console at a location selected by the Contracting Officer's Representative.

3.7.6 Cable trays.- Approximately 25' of cable tray shall be provided and installed suspended from the Junction Room ceiling. The tray system shall be at least 3" deep and 12" wide inside measurements, manufactured of aluminum or galvanized steel equal to Unistrut KUR 3P-2 or KUR 3AE-1, and shall be complete with all fittings, supports, connectors, etc. The trays shall be suspended with a clearance from the Junction Room floor of not less than 10' and shall be located as closely as possible directly under the consoles in the tower cab. It will be necessary to cut a wall partition enclosing the lavatory in order to route the tray properly. This cut shall be neatly made and finished. From the mid-point of the run under the consoles, the cable tray shall be installed to a point directly above the cable raceway in the tower shaft, and a drop out installed at that point with a vertical section down to the cable shaft.

3.8 Controller Equipment. - The required number of microphones and headsets called for in the contract documents shall be provided, as follows:

<u>Equipment Description</u>	<u>Model No.</u>
Microphone	Electrovoice Model No. 602-8961
Headset	Plantronics Model No. MS-50-102

3.9 Test Equipment. - The following pieces of test equipment shall be provided by the contractor at each tower:

<u>Equipment Description</u>	<u>Model or Type Identification</u>
Signal Generator	Hewlett-Packard Model No. HP-608E
Volt-Ohm-Milliammeter (with case and RF Probe)	Triplett Model 801
Wattmeter, VSWR Ind. (with case, VSWR charts, 4 directional detector elements and 2 test cables	Bird Electronic Corp. Model 4303 (Ref. spec. FAA-E-2017)
Modulation Monitor	FAA Specification FAA-E-2307 (FAA type FA-8901A)
Tester, Semiconductor	Sencore Model No. TF 161
Attenuator, Audio	FAA Specification FAA-R-316d (FAA Type FA-8947)
Oscillator, Audio	Hewlett-Packard Model No. HP-200AB
Oscilloscope (DC-500 KHz)	Hewlett-Packard Model No. HP-1206A
Dummy Load, R.F.	Bird Electronic Corp. Model No. 8135
Test Set	GRM Corp. Model No. MTS-8195

3.10 Instruction books. - The contractor shall furnish instruction books for each type of equipment as specified in the contract.

3.11 Documentation.- The contractor shall document all shakedown procedures, functions tested, and results achieved. These documents, along with the contractor certification of the results, shall be turned over to the Contracting Officer or his representative for examination. The Contracting Officer or his representative shall reserve the right to require further tests and documentation as felt necessary to assure proper operation of the system. At the culmination of the shakedown and troubleshooting phase, all equipment shall be turned on and necessary preliminary adjustments made in accordance with instruction books. All equipment in the system shall be left in an energized state for a minimum of 24 consecutive hours before further adjustments are made. The contractor shall prepare two sets of drawings showing corrections made to the system in red pencil, mark them "As-Built," date, sign, and turn them over the Contracting Officer or his representative. The Contracting Officer or his representative shall reserve the right to require further changes to the system after examination of the "As-Built" drawings, only to the extent of achieving proper functional operation.

4. QUALITY ASSURANCE PROVISIONS

4.1 General.- The contractor shall provide and maintain a quality control program which fulfills the requirements of FAA-STD-013, Quality Control Program. The contractor's quality program shall be a scheduled and disciplined plan of events integrating all necessary inspections and tests required to substantiate product quality during design, development, manufacture, fabrication, and assembly. The contractor shall perform or have performed the inspections and tests required to substantiate product configuration and conformance to drawings, specifications, and contract requirements and shall also perform or have performed all inspections and tests otherwise required by the contract.

5. PREPARATION FOR DELIVERY

5.1 General.- The contractor shall be responsible for packaging, marking, and shipping all materials, equipments, documents, and the like, furnished and/or installed under this specification.

6. NOTES

6.1 None.

TABLE OF CONTENTS

<u>Paragraph</u>	<u>Subject</u>	<u>Page</u>
1.	Scope	1
1.1	Scope	1
2.	Applicable Documents	2
2.1	FAA Documents	2
2.2	Federal Standard	3
2.3	Military Specificationss	3
2.4	Department of Commerce Weather Bureau	3
2.5	Commercial Standard	3
3.	Requirements	4
3.1	General	4
3.1.1	Shop Drawings	4
3.1.2	Spare Parts Provisioning	4
3.2	Contractor Furnished Material	5
3.4	Workmanship	5
3.4.1	Protection of Work and Material	5
3.4.2	Restoration and Touch-up	5
3.5	Support Equipment	5
3.5.1	Consoles	6
3.5.2	Electronic Equipment Cabinets	9
3.6	Electronic Installation Requirements	9
3.6.1	Installation	9
3.6.2	Adjustment and Performance Requirements for Radio Channel Control Equipment	10
3.7	Miscellaneous Equipment Installation	16
3.7.1	Altimeter Setting Indicator	17
3.7.2	Wind Measuring System	17
3.7.3	Light Guns with Reels	18
3.7.4	Console Clocks	19
3.7.5	Miscellaneous Monitor/Control Items	19
3.7.6	Cable Trays	19
3.8	Controller Equipment	19
3.9	Test Equipment	20
3.10	Instruction Books	20
3.11	Documentation	21
4.	Quality Assurance Provisions	21
4.1	General	21
5.	Preparation for Delivery	21
5.1	General	21
6.	Notes	21
6.1	None	21

